N 536 - Utilization of Nursing Research in Advanced Practice, Summer 2008

Tzeng, Huey-Ming

Research Design

Contributors
Sonia A. Duffy, PhD, RN
Lisa Kane Low, PhD, CNM, FACNM
Huey-Ming Tzeng, PhD, RN
Design Characteristics

- Maximizes control over factors to increase the validity of the findings
- Guides the researcher in planning and implementing a study
Level of Control: Quantitative Research

- Descriptive
- Correlational
- Quasi-experimental
- Experimental

Increased Control with Design
Concepts Relevant to Research Design (1)

**Causality**

- A \( \rightarrow \) B
- Pressure \( \rightarrow \) Ulcer

**Multicausality**

- Years smoking \( \rightarrow \) Heart disease
- High fat diet \( \rightarrow \) Heart disease
- Limited exercise \( \rightarrow \) Heart disease
Concepts Relevant to Research Design (2)

- **Probability**: Likelihood of an outcome
- **Bias**: Slanting findings
- **Manipulation**: Treatment
- **Control**: All phases of design
**Design Validity**

- **Measure of accuracy of a study**

- **Examined with critique of the following dimensions:**
  - Statistical conclusion validity
  - Internal validity
  - Construct validity
  - External validity
Elements of a Strong Research Design (1)

- Controlling the environment of the study setting

- Levels of controlling:
  - Natural setting
  - Partially controlled setting: e.g., clinics
  - Highly controlled setting: e.g., laboratory
Elements of a Strong Research Design (2)

- Controlling the equivalence of subjects and groups
  - Random subject selection
  - Random assignment to groups
Elements of a Strong Research Design (3)

• Controlling the treatment
  - Choose a treatment based on research and practice
  - Develop a protocol for implementation
  - Document the implemented treatment
  - Use a check-list to determine the extent of completeness to which the treatment was implemented
  - Evaluate the treatment during the study
Elements of a Strong Research Design (4)

- Controlling measurement
  - Reliability
  - Validity
  - Number of measurement methods
  - Types of instruments
Elements of a Strong Research Design (5)

- Controlling extraneous variables
  - Identify and eliminate extraneous variables via sample criteria, choice of settings, or research design
  - Random sampling
  - Sample: Heterogenous, homogeneous, or matching
  - Statistical control
Problems with Study Designs

- Inappropriate for the study purpose or the research framework
- Poorly developed designs
- The research methods were poorly implemented
- Inadequate treatment, sample, or measurement methods
Selecting a Design

- Is there a treatment?
  - No
  - Is the primary purpose examination of relationships?
    - No
    - Descriptive Design
    - Yes
    - Quasi-Experimental Study
  - Yes
  - Is the treatment tightly controlled by the researcher?
    - No
    - Will the sample be studied as a single group?
      - No
      - Correlational Design
      - Yes
      - Experimental Study
    - Yes
    - Will a randomly assigned control group be used
      - No
      - Is the original sample randomly selected?
        - No
        - Yes
        - Experimental Study
      - Yes
Selecting a Descriptive Design

1. Examining sequences across time?
   - No: One Group?
     - No: Comparative Descriptive Design
     - Yes: Data collected across time
       - No: Cross-sectional design
       - Yes: Studying events partitioned across time?
         - No: Trend Analysis
         - Yes: Repeated measures of each subject
           - Yes: Longitudinal design with treatment partitioning
           - No: Cross-sectional design with treatment partitioning
A Typical Descriptive Design

Clarification ➔ Measurement ➔ Description ➔ Interpretation

Variable 1 ➔ Description of Variable 1
Variable 2 ➔ Description of Variable 2
Variable 3 ➔ Description of Variable 3
Variable 4 ➔ Description of Variable 4

Interpretation of Meaning ➔ Development of Hypotheses

Phenomenon of Interest

Research Design 16
A Comparative Descriptive Design

Group I
{variables measured}

Describe

Comparison of Groups on Selected Variables

Interpretation of Meaning

Development of Hypotheses

Group II
{variables measured}

Describe

Describe
<table>
<thead>
<tr>
<th>Describe relationships between/among variables?</th>
<th>Predict relationships between/among variables?</th>
<th>Test theoretically proposed Relationships?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive correlational design</td>
<td>Predictive correlational design</td>
<td>Model testing design</td>
</tr>
</tbody>
</table>
A Descriptive Correlational Design

Measurement

Research Variable 1

Description of variable

Examination of Relationship

Description of variable

Interpretation of Meaning

Development of Hypotheses

Research Variable 2
A Predictive Design

Value of Intercept + Value of Independent Variable 1 + Value of Independent Variable 2 = Predicted Value of Dependent Variable
Selecting The Type of Quasi-Experimental Design

Control Group?
  No
  Pretest?
    No
    One-group post-test only design
    Comparison with population values?
      No
      Suggest reevaluating design
      One group pretest/post-test design
    Yes
    Repeated Measures?
      No
      Strategy for comparison
        No
        Compare treatment & control conditions?
        Yes
  Yes
  Pretest?
    No
    One-group post-test only design
    Comparison with population values?
      No
      Suggest reevaluating design
      One group pretest/post-test design
    Yes
    Repeated Measures?
      No
      Strategy for comparison
        No
        Compare treatment & control conditions?
        Yes
Selecting The Type of Experimental Design

Pretest

No

Post-test only control group design

Yes

Repeated Measurements?

No

Examine effects of confounding variables?

No

Multiple sites?

Pretest/post-test control group design

Yes

Repeated measures design

Yes

Blocking?

No

Comparison of multiple levels of treatment

Examination of complex relationships among variables in relation to treatment

Yes

Randomized Block Design

Nested Designs
## Pretest-Post Test, Control Group Designs

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Findings</th>
<th>Example</th>
<th>Uncontrolled Threats to Validity</th>
</tr>
</thead>
</table>
| Under control of researcher | Comparison of pretest and post-test scores  
Comparison of experimental and control groups  
Comparison of pretest-post-test differences between samples | Your self (1990). The impact of group reminiscence counseling on a depressed elderly population. | Testing  
Mortality  
Instrumentation  
Restricted generalizability as control increases |

### Randomly selected experimental group
- **Measurement of dependent variables**: PRETEST
- **Manipulation of independent variables**: TREATMENT
- **Measurement of dependent variables**: POST-TEST

### Randomly selected control group
- **Measurement of dependent variables**: PRETEST
- **Measurement of dependent variables**: POST-TEST
## Post-Test-Only Control Group Design

<table>
<thead>
<tr>
<th>Randomly selected experimental group</th>
<th>TREATMENT</th>
<th>POST-TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomly selected control group</td>
<td></td>
<td>POST-TEST</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement of independent variables</th>
<th>Measurement of dependent variables</th>
</tr>
</thead>
</table>

**Treatment:** Under control of researcher

**Findings:** Comparison of experimental and control groups


**Uncontrolled threats to validity:**
- Instrumentation
- Mortality
- Limited generalizability as control increases
## Pain Control Management

- **Traditional care**
  - Unit A
  - Unit B
  - Unit C
  - Unit D

- **PRN Medication**
  - Unit E
  - Unit F
  - Unit G
  - Unit H

- **New approach: “Around the clock” medication**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Primary Nursing Care</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary Care</td>
</tr>
<tr>
<td>Unit A</td>
<td>Unit B</td>
</tr>
</tbody>
</table>
Advantages of Experimental Designs

- More controls in design and conducting a study
- Increased internally validity
  - Decreased threats to design validity
- Fewer rival hypotheses
Advantages of Quasi-Experimental Designs

- More practical
  - Ease of implementation
- More feasible
  - Resources, subjects, time, setting
- More generalizable
  - Comparable to practice
Developing the Design Section of Your Proposal

- Identify the design
  - Name it specifically
- Provide a map of the design
- Discuss your rationale for using this design
- Describe threats to the validity of the chosen design